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EXAMINER	
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ART UNIT	PAPER NUMBER
2171	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/854,187	KLEIMAN ET AL.	
	Examiner	Art Unit	
	Uyen T. Le	2171	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 52-147 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 52-147 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 4.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

1. Claims 54-61, 99-105, 115-147 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Note claims 54, 99, 104, 114, 115, 121, 131, 141 merely recite non-functional descriptive material without any practical application. The claimed file system of claim 54 for example recites data stored in blocks associated with a plurality of bits, at least one bit identifying an earlier version of the file system. Although the claim implicitly recites data embodied on a computer-readable medium since bits are digital, the data does not impart functionality to either the data as claimed or to the computer. As such, the claimed invention recites non-functional descriptive material, i.e., mere data. Non-functional descriptive data stored on a computer-readable medium is merely carried on the medium, it is not structurally and functionally interrelated to the medium. Therefore, the claimed subject matter is non-statutory.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 52-54, 59, 60, 62, 63, 65-73, 76, 77, 79, 80, 87-90, 96, 104, 111, 112, 114-116, 120, 121, 123, 125-129, 131-134, 136-139, 141, 144, 142, 146 are rejected under 35 U.S.C. 102(b) as being anticipated by Raymond A. Lorie "Physical Integrity in a Large Segmented Database", ACM Transactions on Database Systems, Vol.2, No. 1., March 1977, pages 91-104.

Regarding claim 52, Lorie discloses all the claimed subject matter including "maintaining a means for recording multiple usage bits per block of said storage means" when Lorie shows Mod bit and shadow bit (see pages 95-97), and "storing in said means for recording multiple usage bits per block, multiple bits for each of said plurality of said blocks of said storage means, at least one of said multiple bits being indicative of block reusability" when Lorie shows using shadow bits to release slots in the current bit map (see page 99). Clearly the shadow bit is indicative of block reusability.

Regarding claim 53, Lorie discloses all the claimed subject matter including "recording multiple usage bits per block of said stored data" (see pages 95-97, Mod bit and shadow bit), "storing multiple bits for each of said plurality of said blocks of stored data, at least one of said multiple bits being indicative of block reusability" (see page 99). Clearly the shadow bit is indicative of block reusability.

Claim 54 merely reads on the file system of Lorie consisting of a plurality of segments (see the abstract). Segments clearly consist of bits since the file system is digital. The claimed "at least one of said plurality of bits...consistent version of said file system" is met when Lorie shows the Mod bits (see page 95) indicating whether the block has been modified or not.

Regarding claim 59, Lorie discloses an element disposed for selecting storage blocks in response to said one bit and said second bit associated with said selected storage block when Lorie shows that the method selects a free slot (see page 97).

Regarding claim 60, Lorie discloses an element disposed for copying said selected storage blocks to a destination when Lorie shows that a modified segment is copied to a new slot (see page 97).

Regarding claim 62, Lorie discloses all the claimed subject matter including "a file system...with regard to said snapshot" (see the abstract, pages 93, 96, 97).

Claims 63, 65 merely read on the fact that snapshots are formed of member storage blocks which have been added to or removed from the original consistent storage blocks. Lorie teaches such features when Lorie shows periodic backup copies of the database (see page 93).

Regarding claim 66, the claimed shadow snapshot is merely a subset of a snapshot, the member storage blocks no longer forming a consistent file system as defined by applicant in the specification. This feature merely reads on the fact that storage blocks are reusable in the system of Lorie. Clearly, a storage image is defined based on the snapshot and shadow snapshot and indicate a set of member storage blocks selected from a plurality of storage blocks as claimed.

Claims 67, 73, 117 merely read on the fact that the Mod bits keep track of blocks to be copied because they had been modified (see page 95).

Claim 68 merely reads on the fact that the system of Lorie includes multiple snapshots (see page 97).

Regarding claim 69, since the snapshot in the system of Lorie exists as a distinct entity, clearly the system can manipulate the snapshot without having to traverse a hierarchy of file system objects within said snapshot.

Regarding claim 70, since snapshots are formed by adding or removing blocks of data, clearly, the data structure is in a format allowing a set management operation as claimed.

Regarding claim 71, Lorie shows that a snapshot includes an array of bits (see page 96). Clearly, said array has one bit for each storage block since storage blocks are made up of bits.

Regarding claim 72, Lorie discloses a plurality of snapshots (see page 101). Clearly, a storage image is determined in response to said plurality of snapshots and said storage image is defining a second set of member storage blocks selected from said plurality of storage blocks.

Regarding claim 76, since the storage image is formed by adding or removing member storage blocks for said snapshot, clearly said storage image is a result of a set management operation as claimed.

Regarding claim 77, Lorie discloses the claimed "wherein said snapshot...without reading any contents of said storage blocks in said plurality" when Lorie shows the use of shadow bits to release slots in the current bit map (see page 99).

Regarding claim 79, Lorie discloses that each snapshot includes a data structure identifying which storage blocks in said plurality of storage blocks are member storage blocks of said snapshot (see page 99).

Regarding claim 80, since only one bit is required to indicate whether the block is part of a corresponding snapshot, clearly the data structure uses no more than 1/100 of storage amount required by said storage block.

Regarding claim 87, the claimed step of defining a storage image of a set of member storage blocks forming a consistent file system other than an active file system merely reads on the fact that snapshots are formed in the method of Lorie (see page 95). Clearly, snapshots form an image stream of a sequence of member storage blocks as claimed.

Claim 88 merely reads on the fact that each block is associated with a snapshot.

Regarding claim 89, Lorie discloses that the image stream is used to reconstruct the file system when Lorie shows restoring a segment (see page 99).

Claim 90 merely reads on the fact that operations are performed on storage blocks to form snapshots (see pages 94, 95).

Regarding claim 96, the claimed periodic intervals merely read on the fact that snapshots are taken whenever the system advances from one consistent point to another (see page 95).

Regarding claim 104, Lorie discloses a file system including a plurality of snapshots, each representing an associated consistent state at an associated selected time (see page 95). Clearly, an indication is being recorded in at least one storage block in order to show which set of storage blocks form a specific snapshot.

Claim 111 merely reads on the fact that a first snapshot consisting of storage blocks forming a consistent file system other than an active file system is formed in the

system of Lorie and that copying its storage blocks does not alter the snapshot in any way (see page 99).

Regarding claim 112, Lorie discloses a second snapshot when Lorie shows saving a new state (see page 99). Clearly, said second snapshot has a set of member storage blocks forming a consistent file system other than an active file system and is represented as an object in said file system. Claim 112, last paragraph merely reads on the fact that copying said member storage blocks do not alter the snapshot in any way.

Claim 114 merely reads on the fact that a snapshot consisting of storage blocks forming a consistent file system other than an active file system is formed in the system of Lorie (see page 99). Clearly, backup and restore operations do not alter the snapshot in any way.

Claim 115 merely reads on the fact that the system of Lorie produces versions of consistent copies of the file system other than the active file system (see page 99).

Regarding claim 116, Lorie discloses a first storage image indicating a set of member storage blocks forming a consistent file system when Lorie shows the consistent original file system (see the abstract). Lorie discloses a sequence of incremental storage image when Lorie shows saving new states (see page 99). Clearly, each image has a predecessor since snapshots are formed as changes occurs and each snapshot represents a consistency point.

Claim 120 merely reads on the fact that snapshots consist of storage image of a consistency point of the file system.

Regarding claim 121, the claimed shadow snapshot is merely a subset of a snapshot, the member storage blocks no longer forming a consistent file system as defined by applicant in the specification. This feature merely reads on the fact that storage blocks are reusable in the system of Lorie (see page 99).

Regarding claim 123, since only one bit is required to indicate whether the block is part of a corresponding snapshot, clearly the data structure uses no more than 1/100 of storage amount required by said storage block.

Regarding claim 125, since the snapshot in the system of Lorie exists as a distinct entity, clearly the system can manipulate the shadow snapshot without having to traverse a hierarchy of file system objects within said snapshot.

Claims 126, 127, 128 merely read on the fact that member storage blocks are removed from a snapshot in response to an operation on the file system. Lorie clearly shows such a feature when Lorie discloses that blocks are reusable (see page 99).

Regarding claim 129, Lorie discloses the claimed "wherein said snapshot...without reading any contents of said storage blocks in said plurality" when Lorie shows the use of shadow bits to release slots in the current bit map (see page 99).

Claims 131, 141 merely recite components of a snapshot. Clearly, a snapshot consists of mark-on-allocate image or mark-on-deallocate image as claimed because snapshots are consistent points of a file system. Evidently, member storage blocks have been added or removed depending on the consistency of the file system at the time the snapshot was taken.

Regarding claim 132, since the snapshot in the system of Lorie exists as a distinct entity, clearly the system can manipulate the snapshot without having to traverse a hierarchy of file system objects within said snapshot.

Regarding claims 133, 193, since snapshots are formed by adding or removing blocks of data, clearly, the mark-on-allocate image and mark-on-deallocate image are in a format allowing an efficient set management operation as claimed.

Regarding claims 134, 144, since only one bit is required to indicate whether the block is part of a corresponding snapshot, clearly the mark-on-allocate image and mark-on-deallocated image use no more than 1/100 of storage amount required by said storage block.

Claims 136-139 are rejected for the same reasons discussed in claims 129-129 above.

Claim 142 merely reads on the fact that snapshots are removed from the file system. Clearly the mark-on-deallocate image in the system of Lorie is disposed as a single object and the system can manipulate the shadow snapshot without having to traverse a hierarchy of file system objects within said snapshot.

Regarding claim 146, Lorie discloses the claimed "wherein said snapshot...without reading any contents of said storage blocks in said plurality" when Lorie shows the use of shadow bits to release slots in the current bit map (see page 99).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 55-58, 61, 74, 75, 78, 81-86, 91, 92-95, 97-103,105-110, 113, 118, 119, 124, 130, 135, 140, 145, 147 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raymond A. Lorie "Physical Integrity in a Large Segmented Database", ACM Transactions on Database Systems, Vol.2, No. 1., March 1977, pages 91-104.

Claim 55 merely reads on the fact that more than one bit is used to indicate status. Although Lorie does not specifically show more than one bit is used for representing the status of the segment, it would have been obvious to one of ordinary skill in the art to use any number of bits to identify a segment depending on users' requirements.

Regarding claim 56, Lorie discloses an element disposed for selecting storage blocks in response to said one bit and said second bit associated with said selected storage block when Lorie shows that the method selects a free slot (see page 97).

Regarding claim 57, Lorie discloses an element disposed for copying said selected storage blocks to a destination when Lorie shows that a modified segment is copied to a new slot (see page 97).

Regarding claims 58, 61, although Lorie does not specifically show "wherein said destination includes...plurality of file systems", it would have been obvious to one of ordinary skill in the art to include any destination depending on users' requirements.

Claims 74, 75 merely read on the fact that operations of logical sum and difference are performed on storage blocks to form storage image for snapshots. Since the snapshots in the system of Lorie exist as distinct entities, it would have been obvious to one of ordinary skill in the art to form a storage image by performing a logical sum or difference on member storage blocks as claimed.

Regarding claim 81, although Lorie does not specifically disclose that the data structure uses no more than four bytes per storage block, it would have been obvious to one of ordinary skill in the art to do so in order to save memory.

.Regarding claim 82, the claimed first and second snapshots are met when Lorie shows saving new states (see page 99). The claimed step of performing an operation on said snapshots merely reads on the fact that snapshots are combinable to form a storage image. It would have been obvious to one of ordinary skill in the art to do so in order to get an image of a plurality of snapshots.

Claims 84, 85 merely read on the fact that operations of logical sum and difference are performed on snapshots. Since the snapshots in the system of Lorie exist as distinct entities, it would have been obvious to one of ordinary skill in the art to make copies by including or excluding a selected range of snapshots and by copying to a destination in order to use existing snapshots to readily create new ones and save processing time.

Regarding claim 86, official notice is taken that it is well known in the art to copy an image to a tape, a disk, a data structure in a second file system, a set of network messages or a destination distributed over a plurality of file system. Therefore, it would

have been obvious to one of ordinary skill in the art to include the above means as destination in order to copy an image depending on availability of the equipment.

Regarding claims 91, 92, although Lorie does not specifically show the step of optimizing said sequence of member storage blocks for a file system operation in a RAID file system, it is well known in the art to use RAID for backing up files. Since the operation of backing up files consumes time and resources, it would have been obvious to one of ordinary skill in the art to optimize said sequence in order to save processing time backing it up to RAID.

Claim 93 merely reads on the fact that the sequence of member storage blocks is optimized depending on storage medium. Since reading in parallel would speed up the operation, it would have been obvious to one of ordinary skill in the art to include optimizing said sequence in response to a physical location in a storage medium and ordering said sequence so that said member storage blocks are read in parallel in order to speed up the operation and save processing time.

Regarding claims 94, 95, Lorie discloses that the storage image represents a complete file system and changes to a file system when Lorie shows the new consistent state and the previously saved state (see page 96).

Regarding claim 97, although Lorie does not specify selecting in response to an operator command, it would have been obvious to one of ordinary skill in the art to include this feature in order to allow an operator to arbitrarily control the selecting step.

Regarding claim 98, although Lorie does not specify repeating the selection in response to a remote device, it would have been obvious to one of ordinary skill in the art to include this feature in order to allow control of the system remotely.

Regarding claim 99, the claimed incremental mirror copy including a base set of storage blocks stored in a first storage medium merely reads on the original set of storage blocks for the file system of Lorie. Lorie also discloses an incremental storage block when Lorie shows saving a new state (see page 98). Although Lorie does not show that the incremental storage block is in a second storage medium, it would have been obvious to one of ordinary skill in the art to store the incremental set of storage blocks in a second storage medium in order to keep track of the changes separately for easy retrieval.

Claim 100 merely reads on the fact that storage media have different speeds and that snapshots are more recent than the original consistent file system. Official notice is taken that it is well known for storage media to have different speeds. Furthermore, clearly snapshots are more recent than the original data in the file system. Therefore, it would have been obvious to one of ordinary skill in the art to include storing the original base set of storage blocks in slower medium than the incremental set of storage blocks in order to save disk space.

Regarding claim 101, clearly the incremental set of storage blocks is responsive to a plurality of updates of said file system since it stores all changes to the file system.

Claim 102 merely reads on the fact that the system of Lorie continuously creates snapshots of the file system (see the abstract). Since each snapshot includes a set of

storage blocks, it would have been obvious to one of ordinary skill in the art to include a up to date set of storage blocks in the incremental mirror copy in order to keep track of the states of each snapshot.

Claim 103 merely reads on the fact that snapshots can be deleted to free up space. Lorie clearly teaches this feature when Lorie shows that after each save all shadow copies are reclaimed (see page 99, discussion).

Regarding claim 105, although Lorie does not specifically show a storage image as claimed, since snapshots exist as distinct entities, it would have been obvious to one of ordinary skill in the art to perform an operation on at least two of said snapshots in order to benefit from existing snapshot formats.

Regarding claim 106, Lorie discloses an incremental mirror of a file system including a first set of storage blocks forming a copy of a first consistent version of the file system when Lorie shows the creation of the first snapshot. The claimed second set of storage blocks including a set of changes between first and second consistent versions is met when Lorie shows the creation of the next snapshot (see the abstract). Clearly, a complete copy of the file system can be constructed from said first and second sets. Although Lorie does not show that the first and second sets are stored in different media, it would have been obvious to one of ordinary skill in the art to do so in order to store the first version in slow inexpensive medium such as tape and the second versions in a faster medium such as disk for saving cost.

Regarding claim 107, clearly tape can store more data than a disk and is slower than a disk.

Regarding claim 108, clearly the second set of member storage blocks is responsive to a plurality of updates of said file system since it stores all changes to the file system.

Claim 109 merely reads on the fact that the system of Lorie continuously creates snapshots of the file system (see the abstract). Since each snapshot includes a set of storage blocks, it would have been obvious to one of ordinary skill in the art to include a up to date set of storage blocks in the second set of member storage blocks in order to keep track of the states of each snapshot.

Claim 110 merely reads on the fact that snapshots can be deleted to free up space. Lorie clearly teaches this feature when Lorie shows that after each save all shadow copies are reclaimed (see page 99, discussion).

Regarding claim 113, although Lorie does not specifically show an image stream including a set of storage blocks of both first and second snapshots, since snapshots exist as distinct entities, it would have been obvious to one of ordinary skill in the art to include both first and second snapshots as claimed in order to benefit from existing snapshot formats. Furthermore, copying said member storage blocks clearly does not alter the snapshots in any way.

Regarding claims 118, 119 although Lorie does not specifically show that said storage image indicates a logical sum or difference of two sets of member storage blocks, it would have been obvious to one of ordinary skill in the art to use logical operations to perform sums and differences on sets of storage blocks in order to benefit from their existing format.

Regarding claim 122, although Lorie does not specifically show a format for shadow snapshots, it would have been obvious to one of ordinary skill in the art to use a format that facilitates set management operation in order to process them efficiently.

Regarding claim 124, although Lorie does not specify a size for a shadow snapshot, it would have been obvious to one of ordinary skill in the art to use about one byte per storage block in order to save memory.

Regarding claims 135, 145, although Lorie does not specifically show that the data structure uses no more than four bytes per storage block, it would have been obvious to one of ordinary skill in the art to make said mark-on-allocate and said mark-on-deallocate images use no more than four bytes per storage block in order to save memory.

Claims 78, 83, 130, 140, 147 merely read on the well-known fact that set management operation clearly includes logical sum or difference.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Uyen T. Le whose telephone number is 703-305-4134. The examiner can normally be reached on M-F 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Safet Metjahic can be reached on 703-308-1436. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

22 September 2004

UYEN LE
PRIMARY EXAMINER